UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/994,954	11/27/2001	Cyril Cabral, JR.	YOR919990509US2 (13171A)	3708

7590 07/22/2002

SCULLY, SCOTT, MURPHY & PRESSER
400 Garden City Plaza
Garden City, NY 11530

EXAMINER	
KIELIN, ERIK J	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 07/22/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/994,954	CABRAL, ET AL.	
	Examiner	Art Unit	
	Erik Kielin	2813	

-- The MAILING DATE of this communication app ars on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 June 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *23-35* is/are pending in the application.

4a) Of the above claim(s) *24 and 32-35* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *23 and 25-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 November 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of the species of Group II, drawn to the cobalt disilicide, in Paper No. 5 is acknowledged. Applicant indicated that claims 23, 25, 26, and 29-35, read on the species.

During a telephone conversation with Leslie Szivos on 10 July 2002, Examiner pointed out that claims 32-35 depend from independent claim 24, drawn to a non-elected species, nickel monosilicide. It was agreed that the claims reading on the elected species were, instead, claims 23, 25, 26, and 29-31.

Although the species of Group II (Co silicide) was elected *without* traverse, Examiner acknowledges that Applicant has suggested that the species of Group I (Ti silicide) should be examined along with the elected species, since both are disilicides. While neither agreeing nor disagreeing with this statement, Examiner will, in the interest of customer service, examine the species of Groups I and II together.

Accordingly, claims 23 and 25-31 will be examined. Claims 24, and 32-35 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to nonelected species, there being no allowable generic or linking claim.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "exposed region" of the substrate, as required by claim 23 (line 3), must be shown or the feature(s) canceled from the claim(s). No

new matter should be entered. There exist no exposed region of the semiconductor substrate in the product as disclosed in the specification and figures. Rather, Examiner assumes and will construe, for the purposes of patentability, the "exposed region" of the substrate to be that region "exposed to" the Si-Ge interlayer which contacts said exposed region of said substrate, as consistent with the specification and the drawings. Note that the suggested change in the claim language, as noted below, would obviate this objection to the figures.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

3. Claim 23 is objected to because of the following informalities:

in claim 23, line 8, replace "said substrate" with --said exposed region of said substrate-- for clarity. Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 29 and 30 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had

possession of the claimed invention. While it is acknowledged that the specification addresses the presence of the oxide layer **12** (claim 29; Figs. 1A, 1B) and its thickness as claimed (claim 30) (specification p. 7, last paragraph), the specification does not support the presence of the oxide layer **12** simultaneously with the presence of the silicide **20**, **24**, in any finally prepared contact structure (Figs. 1E, 1F) because *the oxide layer is intentionally removed* before the silicide is formed (specification, p. 8, first paragraph) or is, alternatively, *dissolved during the annealing to become part of the silicide* (specification, p. 10, lines 30-32). Further regarding claim 29, the specification does not support the limitation that the oxide **12** is "near" the surface of the substrate rather the oxide **12** is specifically "on" the surface of the substrate (specification, p. 7, last paragraph and Figs. 1A-1B.)

Further in this regard, note that **Wolf** (the reference as cited below) points out that titanium reduces native-oxide layers on the surface of single crystal and polycrystalline silicon, just as indicated by Applicant, which has been known for well over 10 years. (See **Wolf**, sentence bridging pp. 147-148.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 23, 25-27, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,710,450 (**Chau** et al.) in view of **Wolf**, Silicon Processing for the VLSI Era, Vol. 2-Process Integration, Lattice Press: Sunset Beach CA, 1990, pp. 144-151.

Chau discloses an electrical contact to a region of a silicon-containing substrate comprising,

a substrate **300** of silicon having an "exposed region" of silicon (region below dotted line in Fig. 3B) wherein the substrate is doped silicon (col. 4, lines 17-21) as further limited by instant claim 31, and the substrate must be one of amorphous, polycrystalline, or single crystal (as further limited by instant claim 25) because these are the only forms that exist; and

a first layer of metal silicide **320** (col. 7, lines 27-44) wherein said metal of said silicide is selected from the group consisting of Ti, Co, and mixtures thereof, and said substrate and said first layer are separated by a Si-Ge interlayer **314** (paragraph bridging cols. 6-7). (See Figs. 3C and 3F.)

Chau does not indicate that the silicide is the "disilicide."

Wolf teaches the benefits of using cobalt and titanium disilicides, $CoSi_2$ and $TiSi_2$, respectively, in forming contacts to source/drain regions, such as those in **Chau**. (See sections entitled "3.9.1.1 Self-Aligned Titanium Silicide Contacts" and "3.9.1.1 Self-Aligned Cobalt Silicide Contacts.")

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the disilicide of either cobalt ($CoSi_2$) or titanium ($TiSi_2$) of **Wolf** as the silicide in the contact of **Chau,** for the reasons indicated in **Wolf**, but particularly because the disilicides of titanium and cobalt have a lower resistivities than the monosilicides, thereby desirably making

lower resistivity contacts. Note also that **Chau** states that other metals may be used to form the silicides (col. 7, lines 43-44), thereby suggesting the use of other metal silicides.

Also, the selection of a known material based on its suitability for its intended use is *prima facie* obvious. It would have been obvious for one of ordinary skill to use a known silicide to use either $CoSi_2$ or $TiSi_2$ as the silicide in **Chau** to achieve the known intended use of low resistivity contacts to source/drain regions.

8. Claims 23, 25-27, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,121,100 (**Andideh** et al.) in view of **Wolf**.

Andideh discloses an electrical contact to a region of a silicon-containing substrate comprising,

a substrate **300** of silicon having an "exposed region" **316** of silicon (Fig. 3e) wherein the substrate is doped silicon (col. 3, last sentence) as further limited by instant claim 31, and the substrate must be one of amorphous, polycrystalline, or single crystal (as further limited by instant claim 25) because these are the only forms that exist; and

a first layer of metal silicide **324** (col. 8, lines 33-38, Fig. 3i), wherein said metal of said silicide is selected from the group consisting of Ti, Co, and mixtures thereof, and said substrate and said first layer are separated by a Si-Ge interlayer **318**. (See col. 7, lines 13-16; Figs. 3f, 3i.)

Andideh does not indicate that the silicide is the "disilicide."

Wolf is applied as above.

Additionally, because **Andideh** does not indicate which silicide should be formed but does indicate that conventional methods are used, one of ordinary skill would be especially motivated to use known, conventional silicides, such as those in **Wolf**.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 6,165,826 (**Chau** et al.) and US 6,326,664 B1 (**Chau** et al.) are continuing applications of US 5,710,450 applied above in the rejection.

US 6,211,560 B1 (**Jimenez** et al.) teaches a contact to a doped silicon substrate wherein there is a SiGe layer between the silicide and the substrate. (See cover Fig.)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached at 703-306-2417. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Erik Kielin
July 11, 2002